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(54) Cleaning agent.

(57) It is described a cleaning agent, especially for cleaning electronic components, optical parts, and circuit boards. The liquid agent is completely CFC-free and biologically absolutely harmless. As carrying agent there is proposed an dipropylene glycol monoether, the active components consisting of propylene glycol ether and/or aminobutanol.

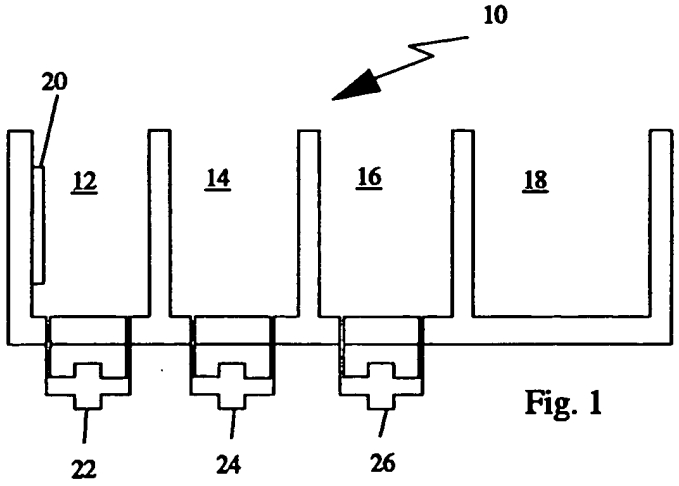

Fig. 1

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The invention is r ferring to a cleaning ag nt, especially to a cleaning liquid used for the cleaning of electronic components, circuit boards, electr nic assembly units, and precision mechanics or optical parts.

Especially electronic circuit boards ar cleaned after th components have been m unted thereon, and the compon nts hav been sold red. Residues r films f grease, resins and similar disposals ar disadvantegous to the resistance between the individual electronic components and could lead to malfunction of the whole circuit. The high density of the components on modern circuit boards increase the problems encountered.

For cleaning the components and the printing boards in the past there have been used CFC's. Due to the problems now recognized caused by the CFC's (ozon-killer) it is an absolute need to avoid the further use of the CFC's.

It is therefor one object of the invention to propose a cleaning agent which is free of CFC's.

It is a further object of the invention to propose a cleaning agent for electronic components which is free of CFC's and additionally contains no halogens and does not harm the environment.

Another object of the invention is to provide a CFC-free cleaning agent having outstanding cleaning performances.

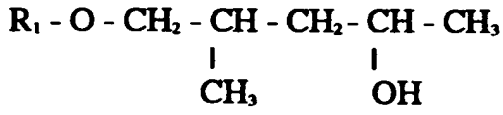
Still another object of the invention is to provide a cleaning agent for electronic components and optical parts which has a high flash point so that no explosion-proof equipment is required under operation.

It is still another object of the invention to propose a cleaning agent for electronic components and/or optical components having biologically degradable components.

These objects are met by the cleaning agent as claimed in claim 1.

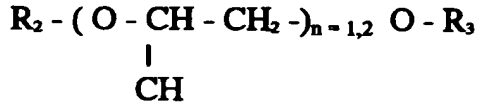
According to the invention there is described a cleaning liquid for the use in cleaning electronic assembly units and optical components, said agent containing absolutely no CFC's.

a carrier compound, said carrier compound being a dipropylene glycol monoether of the common formula



whereby R_1 is chain of carbon atoms of a length between 1 and 6 atoms,

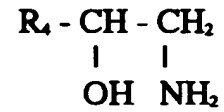
10 - 30 % per weight of a polypropylene glycol ether of the formula:



whereby R_2 is a chain of carbon atoms of a length between 1 and 6, and R_3 is a chain of hydrogen or carbon atoms of a length between 1 and 6 atoms, and

2 - 15 % per weight of an active substance selected from one of the following compounds or a mixture thereof:

a. Compounds of the formula



wh r by R_4 is a chain of 1 to 6 carbon atoms

b. Compounds f th formula

$N(R_5)_3$ wh reby R_5 is a chain of 2 to 18 carbon atoms,

c. Compounds of th formula

$R_6 - N [(CH_2 - CH_2O)_n H]$ wh reby R_6 is a chain of 8 to 18 carbon atoms. and n is number

between 2 and 25.

The great advantage of this cleaning agent in comparison to the cleaning agents according to prior art lies in th fact that by th agent according to this formula it is possibl to clean electronic circuit boards from any r sidu s of flux ag nts having f w solids. Said flux agents with poor solids are introduced into electronic production to avoid a cleaning by CFCs. Due to the prohibition of CFCs many manufacturer are only using soldering means without solids or with only few solids so that the cleaning process can be reduced. Nevertheless a certain amount of the circuit boards produced has still to be cleaned. Of course no manufacturer of circuit boards and user of such cleaning agents is interested in the appliance of two different flux agents depending on whether the boards have to be cleaned or not. By the product according to the invention there is offered for the first time a cleaning agent which is able to remove the residues without leaving a white film disturbing the optical apparence and the asthetic look of the boards.

A special composition of the of the cleaning liquid according to the invention which overcomes the problems stated above consists of a mixture comprising

80 % by weight of ethoxypropoxypropanol,

15 % by weight dipropylene glycol dimethyl ether, and

5 % by weight aminobutanol.

This cleaning mixture is completely free of CFC's and aditionally has the following advantages:

No waste of water since according to the invention there is provided a semiaqueous process for cleaning the components, said process generating absolutely no waste water due to the closed loop system.

Outstanding cleaning performances.

Very good dissolution of flux agents and oils.

Cleaning process free of residual waste gases and effluents.

High flash point. No explosion-proof equipment is required where temperatures of 40 °c to 60 °C are not exceeded.

Minimal evaporation loss.

No toxic components, absolutely no health hazard.

Completely halogen-free (CFC, C and CC) and therefore there is presented absolutely no threat of erosion to the ozone layer nor danger of contamination to the water supply.

Biologically degradable components according to OECD test methods.

The cleaning process requires only ca. 20 - 25 % of the amount of CFC cleaning media previously used. This results in a ca. 20 - 30 % reduction in the costs of chemicals as compared with CFC's.

The mixture consisting of highly effective solvents with very good watersolubility ensure the easy removal of oil, grease and resin residues. The mixture, free of wetting agent, removes even ionic compounds, such as flux activators.

For the appliance of the cleaning agent there is provided a process having at least three stages. In stage 1 the items to be cleaned are immersed into a bath consisting of one of the mixtures described above. Depending on the special materials to be cleaned and to the special residues or film the most suited mixture will be used. It could be of advantage to test some of the mixtures until having found out the mixture having the best cleaning properties for this special case. The cleaning liquid is of room temperature or in a temperature of about 40 to 50 °C. The items will be kept in this bath for a period of usually less than two minutes. If necessary the cleaning process can be assisted by ultrasonic exposure or other suited mechanical measurements.

Filters are provided to retain the particles unsolved. The solution can be used until the impurity has reached about 20 %. Then the solution will be returned to the producer for repreparation.

The second step is water rinsing to remove the cleaning solution. The rinsing water is kept in a closed loop circulation, the rinsing water is pumped through resin adsorbers in a mixed-bed exchanger. If necessary, this rinsing step can be followed by a further rinsing step using deionised and/or demineralized water. Most suited as adsorber resins are styrol resins.

In the last step the items will be dried by a warm air stream or with warm air at 60 °C to 70 °C and a pressure of 2 bar.

In the following the invention will be disclosed in detail by one example and by the drawing, which shows

Fig. 1 a sch matic cleaning station using the liquid of the inventi n in four steps, and

Fig. 2 a schematic cleaning station using th liquid of the invention in three steps.

Example

A mixtur is prepared consisting of 80 % by weight of ethoxypr poxypropanol, 15 % by weight dipropylen glycol dimethyl ther, and 5 % by weight aminobutan l.. The individual components are added together at room temperature and stirred.

The mixture obtained has the following properties:

Density: 0.93 ± 0.02 g/cm^3
Surface-tension: 29.0 mN/m
Boiling-range: 175 - 228 C
Flash point 73 °C

The following matrix shows the efficency of different cleaning liquids, compared with that one according to the invention (the obtained mixture is referred as mixture A):

	Kind of pollution				
cleaning method	grease	ionically dissociatable compositions	resins	harmful to ozon layer	temperature
CFC/alcohol	+	o	o	yes	25 °C
alcohol	+	o	o	no	25 °C
water/alcalic	o	+	o	no	25 °C
terpene/water	+	+	o	no	25 °C
butylglycol/alcohol	+	o	o	no	25 °C
mixture A/rinsing with water	+	+	+	no	25 °C
+ means "very good", o means "good", - means "bad"					

The obtained mixture has been found as especially suited in cleaning electronic components from flux agents with few solids. Further appliances are cleaning of optical parts and mechanical components. The properties in solving oil, grease, and soldering pastes have been found to be excellent.

It is now referred to the drawing. Fig. 1 shows an apparatus for the application of the cleaning mixtures and the cleaning process according to the invention. Reference numeral 10 shows a device having four tanks 12, 14, 16, and 18. In this first tank there is provided an ultrasonic radiator 20 with standard intensity ultrasonics. According to the special items to be cleaned this first tank 12 is filled with a bath of one of the mixtures according to the above described examples, the most suited mixture is found out by tests. The items to be cleaned are immersed into this first tank for about 60 to 120 sec. Simultanously they are exposed to the ultrasonic radiation.

Thereafter the items are taken out and immersed into the second tank 14 containing rinsing water. The following washing in tank 16 with demineralized or deionised water helps to avoid any residues on the items when thereafter dried in tank 18 by a stream of hot air.

The cleaning mixtures according to the invention are filtered by filter 22.

The rinsing water is pumped in closed loops 24 and 26 over adsorber resins which can be regenerated when saturated by the residues brought into the bath. Styrol resins have been found out as being most suited to be used in connection with these special cleaning liquids.

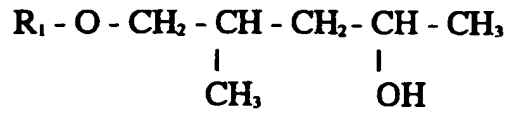
Fig. 2 shows a more simple three stage device. Reference numeral 110 designates a device having three tanks 112, 114, and 116. In this first tank 112 there is provided an ultrasonic radiator 120 with standard intensity ultrasonics. Accordings to the special items to be cleaned this first tank 112 is filled with a bath of one of the mixtures according to the above described examples, the most suited mixture is again found out by tests. The items to be cleaned are immersed int this first tank for about 60 to 120 sec. Simultanously they are exposed to the ultrasonic radiation.

Thereafter the items are taken out and immersed into the second tank 114 containing rinsing water. Th reafter they ar dried in tank 116 by a stream f hot air.

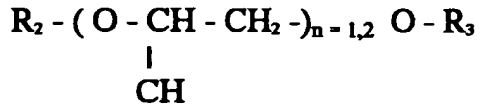
The cleaning mixtures according t the invention are filtered by filter 122. Th rinsing water is pumped in a closed loop 124 absorber resins which can be regen rated when saturated by the residues brought into th bath.

Claims

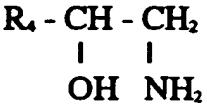
1. Cleaning ag nt consisting of:
a carri r compound, said carri r compound being a dipropylene glycol monoether of th common formula



whereby R_1 is chain of carbon atoms of a length between 1 and 6 atoms,
10 - 30 % per weight of a polypropylene glycol ether of the formula:



whereby R_2 is a chain of carbon atoms of a length between 1 and 6, and R_3 is a chain of hydrogen or carbon atoms of a length between 1 and 6 atoms, and
2 - 15 % per weight of an active substance selected from one of the following compounds or a mixture thereof:
a. Compounds of the formula



whereby R_4 is a chain of 1 to 6 carbon atoms
b. Compounds of the formula
$N(R_5)_3$ whereby R_5 is a chain of 2 to 18 carbon atoms,
c. Compounds of the formula
$R_6 - N[(CH_2 - CH_2O)_n H]$ whereby R_6 is a chain of 8 to 18 carbon atoms, an $1 < n < 26$.

2. Cleaning agent according to claim 1, characterized in that as carrying agent there is provided ethoxypropoxypropanol.

3. Cleaning agent according to claim 1 or 2, characterized in that as polypropylene glycol ether there is provided dipropylene glycol dimethyl ether.

4. Cleaning agent according to claims 1 to 3, characterized in that as active substance there is provided aminobutanol.

5. Cleaning agent according to one of the foregoing claims, characterized in that it is composed of
80 % by weight of ethoxypropoxypropanol,
15 % by weight dipropylene glycol dimethyl ether, and
5 % by weight aminobutanol.

6. A method of cleaning units, especially lectronic assembly units or optical parts, comprising
1. immersing th units t be cleaned into a bath consisting of a cleaning agent according to on of the claims 1 t 5,
2. providing a second bath for wat r rinsing the units to be cleaned, and

3. drying th units in a warm air stream or with warm air.

7. A m thod according to claim 6, characterized in that for nhancing th cleaning performance the units ar additionally xposed to ultrasonic appliance or agitation when imm rsed into th cleaning bath.

8. A method according to claim 6 or 7, characterized in that the water of the second bath is circulated over resin adsorbers and in a mixed bed exchanger in a closed loop.

9. A method according to one of the claims 6 to 8, characterized in that between the second bath and the drying step there is provided a third bath for final rinse using completely demineralized and/or deionised water.

10. A method according to claim 9, characterized in that the adsorber resins consist of styrol resin.

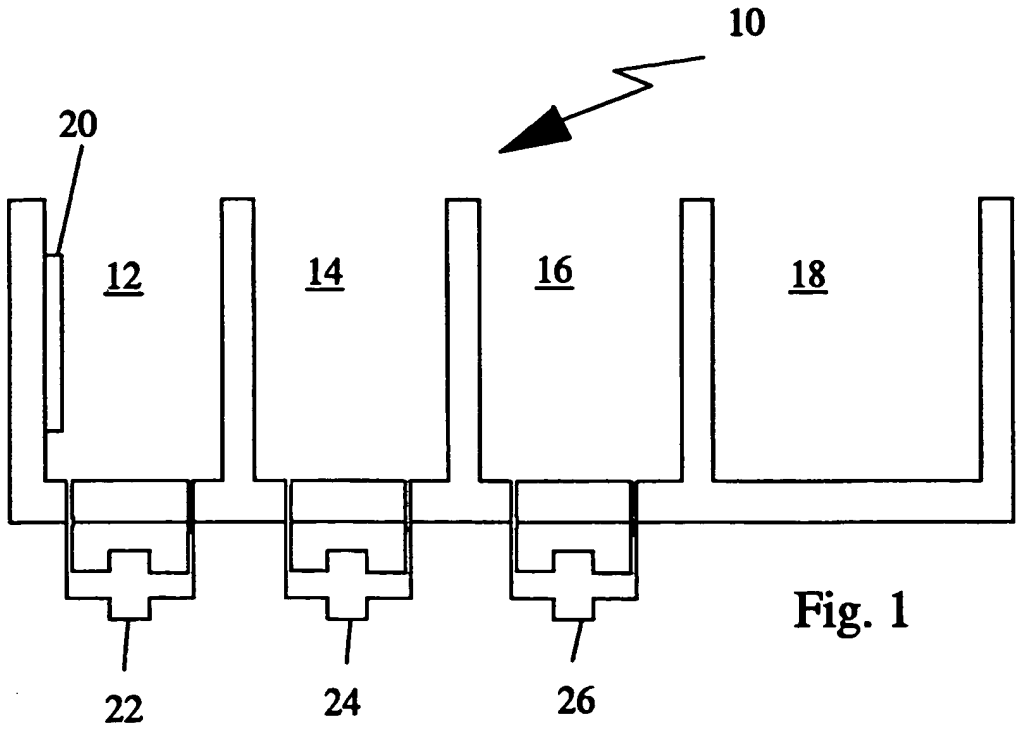


Fig. 1

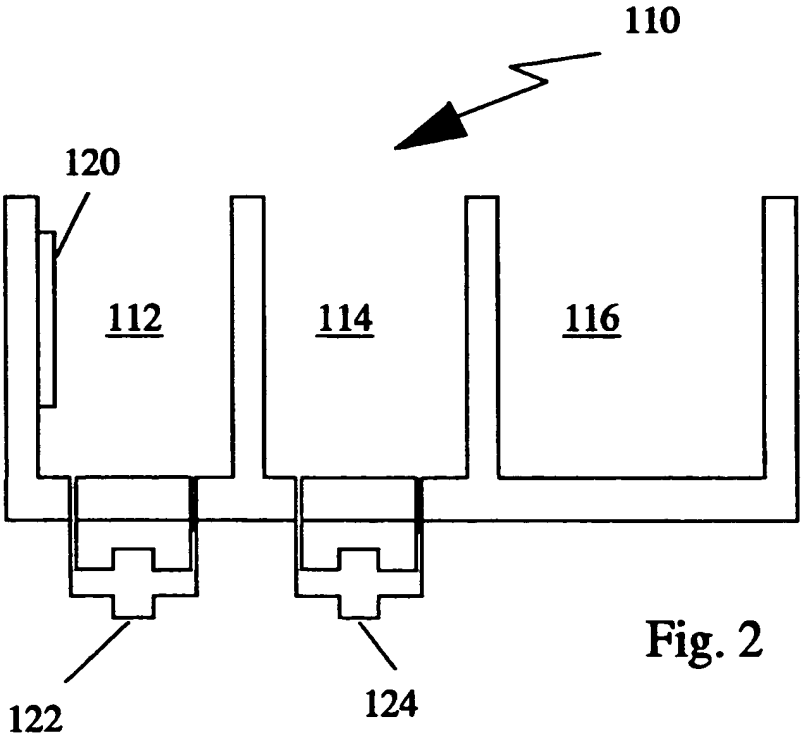


Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 11 3503

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	WO-A-9 100 332 (UNILEVER) 10 January 1991 * claims 1,6-10; examples 6,9 *	1,2,4	C23G5/032 C11D7/50 C11D7/32 C11D1/44
A	FR-A-2 644 174 (SAFETY KLEEN CORP.) 15 September 1990 * claims 1,3; example 1 *	1,3	C11D3/43
A	EP-A-0 330 379 (THE BRITISH PETROLEUM COMPANY) 18 April 1990 * claims 1,3,8,9 *	1,2	
A	EP-A-0 426 512 (ORGANIC CHEMICAL DEVELOPMENT CORPORATION) 8 May 1991		
A	EP-A-0 231 886 (HENKEL) 12 August 1987		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
C23G C11D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 APRIL 1993	LANDAIS A.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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